

CLINICO-EPIDEMIOLOGICAL AND THERAPEUTIC ASPECTS OF BOVINE THEILERIOSIS

G. Muhammad, M. Saqib, M. Athar, M.Z. Khan and M.N. Asi

Faculty of Veterinary Science, University of Agriculture Faisalabad, 38040-Pakistan

ABSTRACT

One hundred and twelve clinical cases of tropical bovine theileriosis occurring in Faisalabad between March 1993 and September 1998 were analysed for frequency distribution of clinical signs (alone and in some combinations) and epidemiological features. In addition, response to buparvaquone and oxytetracycline was evaluated in 72 cases. Clinical signs exhibited included fever ($105.63 \pm 0.11^{\circ}\text{F}$; $n = 112$), uni- or bilateral pronounced swelling of prescapular ($n = 99$), parotid ($n = 54$), prefemoral lymph nodes ($n = 58$), upward visible bulge of temporal fossa ($n = 44$), bull-calf appearance of female calves ($n = 36$), protrusion of haemorrhagic conjunctiva with exophthalmos ($n = 16$), subcutaneous and intramuscular swellings ($n = 11$), pasty or bloody diarrhoea ($n = 38$), tachypnoea, dyspnoea and pneumonia ($n = 10$), convulsions, torticollis and other nervous signs ($n = 4$), haemoglobinuria ($n = 2$), anaemia ($n = 48$), inappetence ($n = 102$), and total refusal to suckle or eat ($n = 10$). Since 100 per cent of the animals exhibited fever together with uni or bilateral swellings of prescapular/parotid or pre-femoral lymph nodes, it is suggested that this combination of signs may be used as a surrogate indicator of theileriosis in field diagnosis where laboratory facilities are lacking. Cross-bred calves aged between 15–21 days accounted for 42 per cent of the total cases although, animals ($n = 5$) aged as young as upto 7 days and as old as 5 years ($n = 2$) were also affected. In general, from February onward, the frequency of the disease steadily increased, peaked in June ($n = 20$) and then steadily declined upto November ($n = 3$). No case occurred in the months of December and January. The disease was strongly associated with the presence of ticks on the body of the affected animals ($n = 99$), *albiet* ticks were absent in 13 affected calves. Sixty seven (93%) of 72 animals treated with buparvaquone (@ 2.5 mg/kg b.wt.) and oxytetracycline (@ 10 mg/kg b.wt.) recovered.

INTRODUCTION

According to FAO, by the year 2000, the shortfall between estimated demand and production of dairy products in Pakistan would range from 2-6 million tonnes, depending upon low and high demand projections (Anonymous, 1987). Crossbreeding of native non-descript cattle with exotic breeds (e.g. Holstein-Friesian and Jersey) has been recommended to narrow the gap between demand and supply of milk. As a flip-side of advent of large scale cross-breeding programmes, ticks and tick transmitted diseases are well known to assume serious dimensions among the progeny. Tropical theileriosis caused by protozoan parasite (*Theileria annulata*), because of fatal nature has been considered as a single most important constraint to cross-breeding programmes in India (Uilenberg, 1982). Chronic tropical theileriosis although usually non-fatal has been reported to cause a significant drop in milk yield in lactating cross-bred cows (Michael *et al.*, 1989).

The cognizance of Pakistani veterinarians and dairy farmers concerning signs, epidemiology and therapy of theileriosis is extremely limited.

Consequently although most dairy practitioners and farmers have encountered this disease on one time or another, they fail to recognize it. Laboratory diagnostic facilities in Pakistan are extremely limited. As such veterinarians have to rely merely upon the clinical signs to diagnose this disease. The field diagnosis of this fatal condition is all the more important since an effective cure is now available for theileriosis.

The present paper describes the clinical signs, epidemiology and treatment of spontaneously occurring theileriosis in dairy cattle. It is an attempt to improve the recognition skills of veterinarians and farmers about this condition.

MATERIALS AND METHODS

Between March 1993 and September 1998, a total of hundred and twelve (112) cases (Jersey = 2; Holstein-Friesian = 4; Sahiwal = 1; Cross-bred = 105) of clinical theileriosis were investigated in terms of:

- a) Frequency distribution of different clinical signs and their combinations;

- b) Epidemiological features (age, month wise frequency distribution of cases, presence or absence of ticks on the body) and;
c) Response to treatment (n = 72).

Cases investigated included those attending the outdoor clinics of the Department of Clinical Medicine and Surgery, University of Agriculture, Faisalabad (n = 35) and those presented to the first author in his private practice (n = 77). The clinical diagnosis in the first 20 cases were confirmed by microscopic examination of the Giemsa's stained lymph node aspirate and peripheral blood smear. Lymph node aspiration was carried out by using a 16 gauge needle which was rapidly pushed into the substance of swollen lymph node (usually prescapular), the hub of the needle then covered with a finger and the needle withdrawn. The needle contents were expelled onto a glass slide, spread into smears and stained with Giemsa stain (Van Amstel, 1982).

Seventy two cases were treated as follows:

1. Cold water hosing of animal's head before treatment and then 3-5 times over the next 36 hours depending upon the severity of the weather.
2. Inj. Butalax (Buparvaquone 5%; Pitman-Moore GmbH, Germany, marketed by ICI Pakistan Ltd). One (n = 64) to two (n = 8) IM injections @ 1mL/ 20 kg body weight in the neck.
3. Inj. Oxy-Con 5% (Oxytetracycline 50 mg/mL) single IM injection @ 10 mg/kg in the thigh muscles followed by oral administration of Cap. Terramycin (Oxytetracycline HCl 250mg; Pfizer Labs, Pakistan) @ 10 mg/kg for four days.

RESULTS

Frequency distribution of signs (alone and in some combinations)

The important clinical signs exhibited by the animals were fever (103 to 109°F), unilateral or bilateral visible swelling of prescapular (Plate 1), parotid (Plate 2), precrural lymph nodes (Plate 3), pronounced upward bulge of temporal fossa (Plate 4), innumerable small size swellings (0.5-1cm in diameter) in muscles and under the skin (Plate 5), outward bulge of conjunctiva with exophthalmos (Plate 6), haemorrhagic spots at the margin of gum (Plate 7), lacrimation (Plate 8), anaemia, diarrhoea, dyspnoea, depression, inappetence, haemoglobinuria, convulsions and torticollis. Some (n = 36) affected female calves had a bull-calf appearance. Frequency distribution of clinical signs (alone and in some combinations) is given in Table 1.

Table 1: Frequency distribution of clinical signs and their combinations among 112 cases of clinical theileriosis recorded at Faisalabad (March 1993 to September 1998)

Clinical signs	Frequency	
	Absolute No.	%
Fever ($105.63 \pm 0.11^\circ\text{F}$)	112	100.0
Lymph node swelling (unilateral or bilateral)		
a) Prescapular	99	88.4
b) Parotid	54	48.2
c) Prescapular and parotid both	44	39.3
d) Prefemoral		
e) Prescapular, parotid and prefemoral	58	51.8
	37	33.0
Fever and swellings of either of above gland	112	100.0
Upward visible bulge of temporal fossa	44	39.3
Uni or bilateral swelling of prescapular lymph nodes and upward visible bulge of temporal fossa	41	36.6
Uni or bilateral visible swelling of prescapular and parotid and prefemoral lymph nodes and upward visible bulge of temporal fossa	18	16.1
Bull calf appearance of female calves	36	32.0
Outward visible protrusion of haemorrhagic conjunctiva with exophthalmos	16	14.3
Cutaneous form (Innumerable small (0.5-1 cm indiameter) swelling under the skin and in muscles	11	9.8
Diarrhea (pasty or bloody)	38	33.9
Respiratory signs (tachypnoea, dyspnoea, pneumonia etc.)	10	8.9
Nervous signs (Convulsions, torticollis etc.)	04	3.92
Haemoglobinuria	02	1.8
Anaemia	48	42.7
Inappetence	102	91.1
Total refusal to suckle or eat	10	8.9
Lacrimation	80	71.4

Effect of age

Calves aged up to 35 days accounted for 86.6% (n=97) of the cases. The highest frequency (42%; n=47) of the disease was recorded among calves aged 15 to 21 days. In general as the age advanced, the frequency of the disease decreased, although one case

was recorded in a heifer aged 2 years and two cases in cows aged as much as 5 years (Table 2).

Table 2: Frequency distribution of clinical theileriosis in relation to age among 112 cases, investigated between March 1993 to September 1998, at Faisalabad.

Age of Animal (Days)	Frequency	
	Absolute No	Percentage
Upto 7	5	4.5
8-14	13	11.6
15-21	47	42.0
22-28	13	11.6
29-35	19	17.0
36-49	3	2.7
50-60	2	1.8
61-70	2	1.8
71-84	3	2.7
85-112	1	0.9
113-168	1	0.9
2-years	1	0.9
5-years	2	1.8

Effect of season

The months of December and January were associated with an absence of the disease. In general, from February onward, the frequency of the disease steadily increased, peaked in June (n = 20) and then steadily declined upto November (n = 3) (Fig. 1).

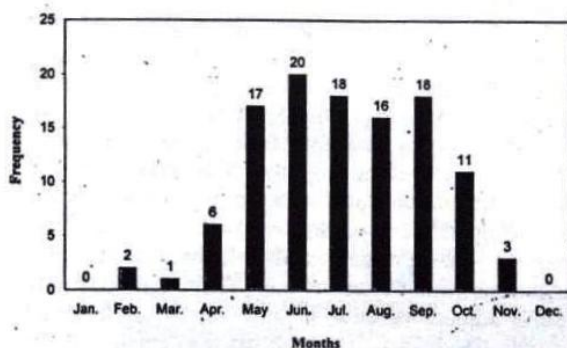


Fig. 1: Month-wise frequency distribution of bovine clinical theileriosis among 112 cases recorded at Faisalabad (May 1993 to Sept. 1998).

Association of disease with tick infestation

The ticks were absent on the bodies of 13 calves (11.6%) suffering from clinical theileriosis. This subset of cases comprised calves aged between 7 and 15 days.

Response to treatment

Of the 72 animals treated with buparvaquone and oxytetracycline, 67 (93 %) responded to this treatment. The body temperature dropped to nearly normal (101-102 °F) 2-3 days after initiation of treatment. Five cases (6.94%), which died despite treatment were either suffering from cerebral theileriosis (n = 2) or were terminally ill (n = 3). Although, the animals which responded to treatment resumed suckling/eating and were bright within 1-2 days of treatment, the swelling of the enlarged lymph nodes persisted for 15-45 days after initiation of treatment.

DISCUSSION

The syndrome of persistent fever together with uni or bilateral visible swelling of lymph nodes (prescapular, parotid or prefemoral) epitomized clinical theileriosis as this combination of signs was present in 100% of the cases in the present study. Therefore, where laboratory diagnostic facilities are lacking, these signs considered in concert can be relied upon to diagnose theileriosis in the field. Such clinical manifestations as innumerable small nodules in muscles and skin and outward visible protrusion of haemorrhagic conjunctiva with exophthalmos although pathognomonic for clinical theileriosis were present in 11 (9.81%) and 16 (14.3%) cases, respectively. Cutaneous form of bovine theileriosis characterized by generalized skin swellings (0.5 to 1 cm in diameter) has been described by Sudhan *et al.* (1992); Ahourai *et al.* (1988) and Manickam *et al.* (1984). Majority (n = 102) of cases continued to suckle/eat during the course of disease. This observation accords with that reported by Ashfaq *et al.* (1983). Hemoglobinuria was noted in two (1.8 %) cases. Gautam *et al.* (1970) have also reported this uncommon sign of theileriosis. In as much as haemolysis is not a feature of theileriosis and anaemia is corollary to erythrophagocytosis resulting from some autoimmune mechanisms (Dhar and Gautam, 1979; Lal and Soni, 1985). Haemoglobinuria in the present study may be attributed to some concurrent haemolytic agent. A wide variety of clinical signs of

different severity as noted in the present might have to do with the differences in the virulence of 'J' and Mukeshwar strains of *Theileria annulata* reported from Pakistan (Suddequi, 1977 cited by Bulman *et al.*, 1979). The signs in general were consistent with those reported by previous workers (Gautam *et al.*, 1970; Sharma and Gautam, 1973; Ashfaq *et al.*, 1983; Hawa *et al.*, 1988; Mehta *et al.*, 1988; Bansal and Sharma 1989; Bagherwal, 1989; Sudhan *et al.*, 1992). As far as could be ascertained, there is only one previous report (Hawa *et al.*, 1988) describing the frequencies of the clinical signs. Although, signs noted in the present study were compatible with those described in that report, their frequencies differed appreciably. Moreover, combination of clinical signs which could typify clinical theileriosis were not reported by these workers.

In the present study, 89/112 (79.5%) cases were recorded from May to September which are the summer months in Pakistan. The peak incidence (17.65 %) was noted in the June and the cases continued occurring till November (Fig. 1). These findings concur with those reported from Iran (Bazargani *et al.*, 1988). The period of occurrence of disease (February to November) and the peak incidence month (June) in the present study are in a broad agreement with the corresponding findings of Nepalese workers (Acharya and Pradhan, 1996). The chances of transmission of theileria by infected ticks have been shown to be higher at high ambient temperature (37°C) as compared to a low temperature (18°C) (Ochanda *et al.*, 1988). High ambient temperature also stimulates the maturation of theileria in the salivary glands of ticks to mature sporozoites (Norvel, 1988). Theileriosis is transmitted by the ticks which are more active during the summer. This may explain the more frequent occurrence of theileriosis during summer months in the present study. On account of seasonality of calving in cattle (months February and March) more calves are candidate to develop theileriosis during these months.

Of the 112 cases investigated in the present study, 97 (86.6 %) cases occurred in calves aged less than 35 days. The highest frequency (41.96%), of the disease was recorded among the calves aged between 15 and 21 days. This observation accords with those of previous Pakistani studies (Ashfaq *et al.*, 1983; Hussain *et al.*, 1990). Thus in concurrence with the findings of Indian (Shastri, 1989), Iranian (Ahourai *et al.*, 1988) and Iraqi workers (Hawa *et al.*, 1988), theileriosis in Pakistan appears to be mainly a calfhood problem. That the neonates carrying exotic

taurine blood are far more susceptible to theileriosis than counterparts of the local cattle breeds (Hawa *et al.*, 1988; Dolan *et al.*, 1992) was borne out by the findings of the present study.

Iranian (Ahourai *et al.*, 1988) and Indian workers (Mishra *et al.*, 1994) contend that when the vector tick (*Hyalomma anatolicum*) is not present on the bodies of the animals, *Theileria annulata* infection could have been acquired by the calves through *in utero* transmission. This may explain the occurrence of theileriosis in 13 calves (11.6 %) in the present study wherein ticks could not be found on their bodies. The occurrence of clinical theileriosis predominantly in young calves further underscores the possibility of *in utero* acquisition of theileria infection.

Of 72 cases treated with buparvaquone and oxytetracycline, 67 (93 %) recovered. Five treated animals which died were either suffering from cerebral theileriosis (n = 2) or were at a very advanced stage of the disease (n = 3) when sent for to treat. That buparvaquone is not usually effective in cerebral theileriosis (Dhar *et al.*, 1988) and that very advanced cases of theileriosis are poor responder to this drug (Hussain *et al.*, 1990) was substantiated by the findings of the present study. In the treatment of spontaneously or artificially induced theileriosis, cure rate as low as 58.8 % (Shastri, 1989) to as high as 98.03 to 100 percent (Dhar *et al.*, 1987; Benerjee *et al.*, 1988; Hussain *et al.*, 1990; Sharma and Mishra, 1990 ; Singh *et al.*, 1993b) have been reported with 1-2 injections of buparvaquone. In concurrence with the observations of Dhar *et al.* (1987) and Michael *et al.* (1989), the body temperature returned to nearly normal 2 to 3 days after administration of buparvaquone. Degeneration of theilerial piroplasms after administration of buparvaquone occurs over 1 to 4 days (Unsoren and Kurtedede, 1988). This may account for the time lag of 2 - 3 days between administration of buparvaquone and return of the body temperature to normal.

In the present study, buparvaquone was adjuncted with oxytetracycline. This antibiotic is a useful adjunct because in addition to antitheilerial activity (Bagherwal, 1989), it helps to ameliorate the pneumonic changes (Khanna *et al.*, 1983) and is curative for anaplasmosis which may occur concurrently (Dolan *et al.*, 1992).

The median age of calves affected with clinical theileriosis in the present study was 15 days. No theilerial vaccine is currently available in Pakistan. Moreover, *Theileria annulata* schizonts vaccines

although claimed to be effective are not recommended for use in calves aged less than 2 weeks (Bansal and Sharma, 1989). Other workers (Singh *et al.*, 1993a) forbid theilerial vaccination in calves less than four months. This recommendation may be due to non development of immunocompetence in young animals (Subramanian *et al.*, 1989). Given that clinical theileriosis in Pakistan is a problem predominantly of cross-bred neonatal calves, this special subset of cattle population may be protected against this disease by chemoprophylactic use of buparvaquone during the first week of neonatal life as has been demonstrated by Indian workers (Shastri, 1989; Dhar *et al.*, 1990). Nonetheless, it is pertinent to underscore here that calves challenged with ground up tick supernates (GUTS) 15 days after administration of buparvaquone have been found to develop typical clinical theileriosis (Kumar *et al.*, 1991). A short half life (26.44 hrs) of buparvaquone (Kinabo, 1989) may explain this resusceptibility. Therefore, when attempting chemoprophylaxis with buparvaquone, repeat dosing 7-10 days later may be justified. The present study dealt with only the clinical forms of theileriosis. Work on subclinical theileriosis and seroprevalence, is therefore clearly warranted.

REFERENCES

- Acharya, K.P., and S.M.S. Pradhan, 1996. Study of blood protozoan diseases with special reference to theileriosis in Eastern Teri of Nepal. *Bull. Vet. Sci. Anim. Husb. Nepal*, 24: 55-58.
- Ahourai, P., P. Hooshmand-Rad, A. Ezzi, M.R. Gholami, H.A. Moghaddam and R. Hashemi-fesharaki, 1988. Clinical and patho-anatomical studies on cases of theileriosis in calves histopathologically confusable with juvenile leukosis. *Arch. Inst. Razi*, 38: 11-26.
- Anonymous, 1987. Report of FAO/Asian, Dev. Bank. Coop. Programme, Pakistan Livestock Sector Study, Phase-I Report. Vol. I. 55-87, As-Pak 39, FAO, Rome, Italy.
- Ashfaq, M., M. Ajmal, and A. Shabbir, 1983. An outbreak of theileriosis in crossbred neonate calves. *Pakistan Vet. J.*, 3: 44-46.
- Bagherwal, R.K., 1989. Oxytetracycline (TELON LA) as chemotherapeutic agent against bovine tropical theileriosis in crossbred cattle. *Indian Vet. J.*, 66: 653-655.
- Banerjee, P.L., C. Guha, J. Samaddar, A. Chanda, and R.R. Potadar, 1988. Efficacy of a new hydroxynphthoquinone derivative, WB 720C (buparvaquone) on clinical cases of bovine theileriosis. *Indian Vet. J.*, 65: 720-724.
- Bansal, G.C., and N.N. Sharma, 1989. Prophylactic efficacy of buparvaquone in experimentally induced *Theileria annulata* infection in calves. *Vet. Parasitol.*, 33: 219-224.
- Bazargani, T.T., S. Rahbani, and M. Bagheri, 1988. Seasonal incidence of theileriosis in different breeds of cattle around Tehran and evaluation of therapeutic value of parvaquone against the disease. *J. Vet. Faculty, Univ. Of Tehran*, 42: 18-23.
- Bulman, G.M., G.M. Arzo, and M.N. Nassimi, 1979. An out break of tropical theileriosis in cattle in Afghanistan. *Trop. Anim. Hlth. Prod.*, 11: 17-20.
- Dhar, S., and O.P. Gautam, 1979. Observation on anaemia in experimentally induced *Theileria annulata* infection of calves. *Indian J. Anim. Soc.*, 49: 122-126.
- Dhar, S., D.V. Malhotra, C. Bushan, and O.P. Gautam, 1987. Treatment of clinical cases of bovine tropical theileriosis with buparvaquone (BW 720C). *Indian Vet. J.*, 64: 331-334.
- Dhar, S., D.V. Malhotra, C. Bushan, and O.P. Gautam, 1988. Treatment of experimentally induced *Theileria annulata* infection in cross-bred calves with buparvaquone. *Vet. Parasitol.*, 27: 267-275.
- Dhar, S., D.V. Malhotra, C. Bushan, and O.P. Gautam, 1990. Efficacy of buparvaquone for chemoimmunoprophylaxis against *Theileria annulata* infection in neonatal bovines. *Indian J. Comp. Microbiol. Immunol. Infect. Dis.*, 11: 7-10.
- Dolan, T.T., R. Injairu, F. Gisemba, J.N. Maina, G. Mbadi, S.K. Mbwira, G.H.M. Mulela, and D.A.O. Otheieno, 1992. A clinical trial of buparvaquone in the treatment of East-Coast Fever. *Vet. Rec.*, 130: 536-538.
- Gautam, O.P., R.D. Sharma, and D.S. Kalra, 1970. Theileriosis in exotic breeds and a Sahiwal calf. *Indian Vet. J.*, 47: 78-83.
- Hawa, N., D.G. Rae, S. Younis, W. Mahadi, R. Ibrahim, and W.A.L. Wahab, 1988. Efficacy of Paraquone in the treatment of naturally occurring theileriosis in cattle in Iraq. *Trop. Anim. Hlth. Prod.*, 20: 130-136.
- Hussain, A., M.A. Khokhar, A.H. Awan, and M.A. Chaudhry, 1990. Efficacy of Butalex (buparvaquone) in naturally affected cattle with *Theileria annulata*. *Pak. J. Vet. Res.*, 3: 6-8.
- Khanna, B., M. Dhar, and O. Gautam, 1983. A chemotherapy of experimentally *Theileria annulata* infection in bovine calves. *Indian Vet. J.*, 60: 603-606.
- Kinabo, L.D.B., 1989. Pharmacology of new antitheilerial drugs paraquone, buparvaquone and halofugione. *Vet. Bull.*, 59: 961-968.

- Kumar, A., S. Sarup, R.D. Sharma, A.K. Nachani, and P. Goel, 1991. Chemoprophylactic efficacy of buparvaquone against bovine tropical theileriosis. *Indian Vet. J.*, 68: 514-516.
- Lal, H. and J.I. Soni, 1985. Erythro-phagocytosis in relation to anaemia in acute *Theileria annulata* infection in cross-bred calves. *Indian J. Vet. Soc.*, 2: 85.
- Manickam, R., S. Dhar, R.P. Singh, and M.U. Kharole, 1984. Histopathology of cutaneous lesions in *Theileria annulata* infection in calves. *Indian Vet. J.*, 61: 13-15.
- Mehta, H.K., R.S. Sisodia, and K.S. Miraula, 1988. Clinical and haematological observations on experimentally induced cases of bovine tropical theileriosis. *Indian Vet. J. Anim. Sci.*, 58: 584-587.
- Michael, S.A., A.H.E. Refah, N. McHardy, and D.G. Rae, 1989. Effect of treatment of chronic theileriosis with buparvaquone on milk yields. *Trop. Anim. Hlth. Prod.*, 21: 218-222.
- Mishra, A.K., N.N. Sharma, and S.C. Srivastava, 1994. *Theileria annulata* infection in neonatal bovine calves. *Acta Veterinaria Hungarica*, 42: 99-102.
- Norvel, R.A.I., 1988. Tick control relation to the epidemiology of theileriosis. In: *Theileriosis in Eastern, Central and South Africa. Proc. Workshop on East Coast Fever. Immunization Lilongwe, Malawi*. pp: 111-120.
- Ochanda, H., A.S. Young, J.J. Mutugi, J.J. Mumo, and P.L. Omwoyo, 1988. The effect of temperature on the rate of transmission of *Theileria parva* infection to cattle by its tick vector, *Rhipicephalus appendiculatus*. *Parasitol.*, 97: 239-245.
- Sharma, N.N., and A.K. Mishra, 1990. Treatment of bovine tropical theileriosis with buparvaquone. *Trop. Anim. Hlth. Prod.*, 22: 63-65.
- Sharma, R.D., and O.P. Gautam, 1973. Cerebral theileriosis in Haryana calf. *Indian Vet. J.*, 50: 823-828.
- Sharma, R.D., and O.P. Gautam, 1973. Theileriosis. II. Clinical cases in indigenous calves. *Indian Vet. J.*, 48: 83-91.
- Shastri, U.V., 1989. Chemotherapy and chemoprophylaxis of *Theileria annulata* infection in cross-bred with buparvaquone (BW 720 C). *Indian Vet. J.*, 66: 342-344.
- Singh, D.K., M. Thakur, P.R.S. Raghav, and B.C. Varshney, 1993a. Chemotherapeutic trial with four drugs in cross-bred calves experimentally infected with *Theileria annulata*. *Res. Vet. Sci.*, 54: 68-71.
- Singh, J., J.S. Gill, M.S. Kwatra, and K.K. Sharma, 1993b. Treatment of theileriosis in cross-bred cattle in the Punjab. *Trop. Anim. Hlth. Prod.*, 25: 75-78.
- Subramian, G., G.C. Bansal, D. Ray, and R.V.N. Srivastava, 1989. Effect of live schizont (*Theileria annulata*) vaccine in neonatal cross-bred bovine calves. *Indian J. Anim. Sci.*, 59: 9-13.
- Sudhan, N.A., K.D. Prasad, A.K. Sinha, S. Azmi, and K.P. Sinha, 1992. A case of cutaneous theileriosis in an indigenous cow. *Indian Vet. J.*, 69: 59-60.
- Uilenberg, G., 1982. Disease problems associated with the introduction of European cattle in the tropics. *Proc. XIIth World Congress on Diseases of Cattle. Vol. II. The Netherlands World Assoc. for Buiatrics. Amsterdam*. pp: 1025-1031.
- Unsoren, H., and A. Kurtedede, 1988. Studies on buparvaquone treatment of bovine theileriosis in the Ankara area. *Veterinarian Fakultesi Dergisi, Ankara Universite*, 35: 47-54.
- Van Amstel, S.R., 1982. Bovine cerebral theileriosis. Some aspects on its clinical diagnosis. *Proc. XIIth World Congress on Diseases of Cattle. Vol. II. The Netherlands World Association for Buiatrics, Amsterdam*. pp: 981-985.

PHOTOGRAPHS OF CLINICAL THEILERIOSIS



Plate 1: Pronounced swelling of prescapular lymph node in a calf



Plate 2: Pronounced swelling of parotid lymph node in a calf

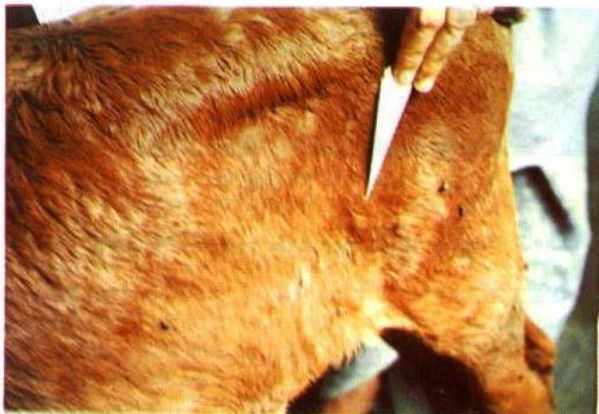


Plate 3: Pronounced swelling of precrural lymph node in a calf

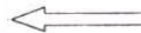
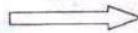


Plate 4: Pronounced upward bulge of temporal fossa in a calf



PHOTOGRAPH OF CLINICAL THEILERIOSIS



Plate 6: Outward bulge of conjunctiva with exophthalmos in a calf



Plate 8: Lacrimation with visible oedematous swelling of conjunctiva in a calf

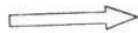


Plate 7: Haemorrhagic spot at the margin of gums in a calf



Plate 5: Innumerable skin nodules in a calf (cutaneous hair closely clipped).

